



# PARIKH

*Practicing in the Geosciences*

Geotechnical ■  
Environmental ■  
Materials Testing ■  
Construction Inspection ■

**T. Y. Lin International/CCS**  
2010 Crow Canyon Place, Suite 350  
San Ramon, CA 94583

August 10, 2006  
Job No.: 205140.10

Attn.: Mr. Don Greb

Sub: Foundation Recommendations for Sound Wall 259  
I-580 Vasco to Springtown Sound Wall Project  
Livermore, Alameda County, California

Dear Mr. Greb:

As requested, we are providing the foundation recommendations for the proposed Sound Wall 259 as part of the I-580 Vasco to Springtown Sound Wall Project, in the City of Livermore, California.

### **Proposed Construction**

The project consists of constructing a new sound wall approximately 300 meters long, and 5 meters high. The proposed sound wall will be on the northwest side of westbound I-580, approximately 0.9 km southwest of the intersection of I-580 and Vasco Road in the City of Livermore, California. Per discussion with the designer, it is planned to use standard Caltrans Sound Wall – Masonry Block on Type 736 Barrier. The structure will be supported on Cast-In-Drilled-Hole (CIDH) concrete piles.

### **Subsurface Conditions**

Six borings were drilled up to 7.6 m deep below existing grade by Caltrans within the project vicinity in November 2001, and additional six new borings (259-1 thru 259-6) were drilled up to 9.1 m deep below grade by Parikh Consultants, Inc. in February 2006 for the proposed sound wall. Based on the boring data, the subsoils generally consist of stiff to hard cohesive material with occasional interbedded sand lenses. Soft to firm lean clays were encountered in Boring 259-1 (Sta. 219+03±) and 259-2 (Sta. 220+08±), located at the southwest end of the project.

Isolated loose to medium dense sand lenses up to 1.5 m thick were encountered in Boring 259-5 and 259-6 at approximately Elev. 154 m. These submerged sand lenses are subject to liquefaction during earthquakes. However, such loose sand lenses were not encountered in the nearby borings (B-7, B-9 and B-10, Caltrans 2001). In our opinion, post-liquefaction settlement on the order of 25 mm (1 inch) may be expected during strong earthquake, but probably would be random and localized.

Based on the boring data, groundwater was encountered at approximate Elev. 155.1 to 157.5 m during field exploration. However, the groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuation, surface and subsurface flows, ground surface run-off, and other factors that may not be present at the time of investigation.

## **Foundations**

The proposed sound wall is approximately 400 m long with wall height of 5.0 m. It is planned to use standard Caltrans Sound Wall – Masonry Block on Type 736 Barrier. The wall will be supported on barrier and CIDH concrete pile.

According to the boring data, the foundation subsoils generally consist of firm to hard fat/lean clay. Per discussion with the designer, the project will have various ground profiles of both level ground (Case 1) and sloping ground (Case 2) along the wall alignment. Based on the subsurface condition and ground profiles, an angle of shearing resistance ( $\phi$ ) of 30° is recommended for the standard Caltrans Sound Wall design. Please refer to Caltrans Standard Plans B15-6 thru B15-8 for foundation details.

The saturated loose sand lenses encountered in Borings 259-5 and 259-6 may be subject to liquefaction. As stated in the previous section, post-liquefaction settlement may be expected. The estimated settlement is on the order of 25 mm, and probably would be random and localized.

Caltrans standard specification for "Cast-in-Place Concrete Piling" should be used for the construction of CIDH concrete piles. The borings encountered sporadic sand lenses and the logs indicate groundwater at approximately 2.5 m below the existing grade. Sandy material and groundwater is expected during pile construction. Therefore, ravelling or caving might be expected which may require additional drilling and cleaning effort and may increase the concrete volume for the piles. The use of temporary steel casing should be expected. It is prudent to make the contractor aware of the presence of the groundwater so that he takes appropriate steps to comply with the standards and maintain the integrity of the piles.

## **Culverts**

For Sound Wall No. 259, a drainage system is proposed along the wall alignment. It is recommended to wrap the pipe and the bedding with a layer of filter fabric conforming to Caltrans Standard Specification (Section 88-1.03). The culvert excavation and bedding material should follow Caltrans Standard Specification (Section 19-3.02). The bedding should be extended to at least 0.3 m (1 foot) above the pipe crown.



## Corrosion Investigation

Per Caltrans guidelines no specific geotechnical investigation is required for small diameter culverts (600 mm and under), and Standard Plans and Specifications can be used for design. During our investigation, three corrosion tests were performed along the proposed sound wall. The corrosion investigation for this project was performed in general accordance with the provisions of California Test Method 643. A summary of the corrosion test results is presented below.

**SUMMARY OF CORROSION TEST RESULTS**

Boring No.	Station (m)	Offset From "B9M" Line (m)	Corrosion Tests					
			Sample No.	Depth (m)	pH	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)
259-3	221+13	Lt. 28.6	1	0.6	8.18	1130	19.1	14.5
259-4	221+98	Lt. 24.1	1	0.6	7.52	1630	20.8	52.7
259-5	223+00	Lt. 25.5	1	0.6	7.81	380	207.6	115.8

Based on the results obtained, corrosion analyses were carried out using Caltrans CULVERT 4 program. The analysis results and general recommendations for culverts are attached in this report (Table 1).

Based on CULVERT 4 results, Standard reinforced concrete pipe design is suitable with Type IP (MS) modified cement or Type II Modified cement. This is a minimum requirement as per Caltrans Bridge Design Specifications (Section 8.22).

The thickness of corrugated steel and steel spiral rib pipes can vary from location to location. Based on the results, corrugated aluminum and corrugated aluminized steel pipe generally are not suitable within the project area. For steel pipes, 1.3 mm thick pipe can be used [50-yr., Galv. with polymeric coat. (90 invert)]. Thermoplastic pipe can be used as an alternative and should not have any corrosion concerns. However, the types of thermoplastic pipe that can be used will depend on the height of fill, available sizes and manufacturer's specifications.




T. Y. Lin International/CCS  
Job No. 205140.GDR (SW #259, rev.)  
August 10, 2006  
Page 4

Please be advised that we are performing a professional service and that our conclusions are professional opinions only. All work done and all recommendations made are in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work.

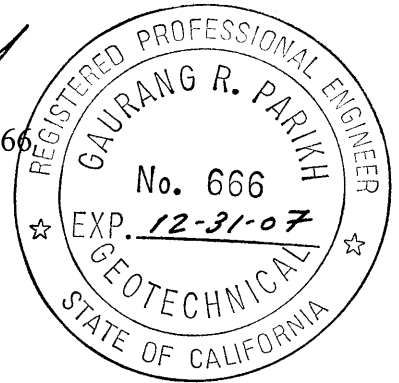
Very truly yours,  
PARIKH CONSULTANTS, INC.



Frank Y. Wang, P.E., 67751  
Project Engineer



Gary Parikh, P.E., G.E., 666  
Project Manager



Attachment:

1. Site Plan (1)
2. Log of Test Borings
  - 259-1 thru 259-6 (Parikh Consultants, 2006) (2)
  - B-1A, B-3A, B-5A, B-7, B-9 and B-10, (Caltrans, 2001) (2)
3. Table 1. Recommended Minimum Thickness and Protective Measures for Culverts (1)
4. Culvert 4 Results (3)

FW {S:\Ongoing Projects\2005\205140 RTE 580 HOV lane\Soundwall 259}






**LEGEND**

- Approx. Exploratory Boring Location (PARIKH, 2006)
- Approx. Exploratory Boring Location (Caltrans, 2001)

SCALE 1:1250

**SITE PLAN**

Note: All units are in meters unless otherwise specified  
Reference Map was provided by TYLIN International/ CCS

	PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS ENGINEERING		I-580 VASCO TO SPRINGTOWN SOUND WALL PROJECT SW 259 ALAMEDA COUNTY, CALIFORNIA	
			JOB NO.: 205140.GDR	PLATE NO.

LEGEND OF BORING OPERATIONS

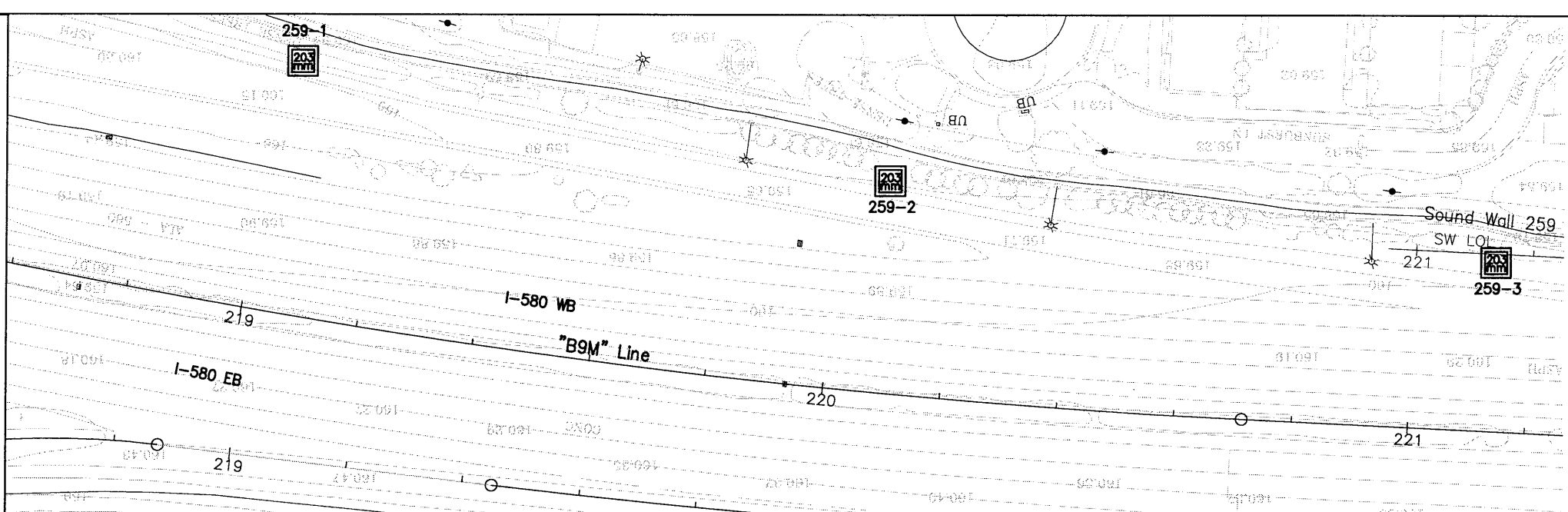
TEST DESIGNATIONS

IN-SITU LAB & FIELD

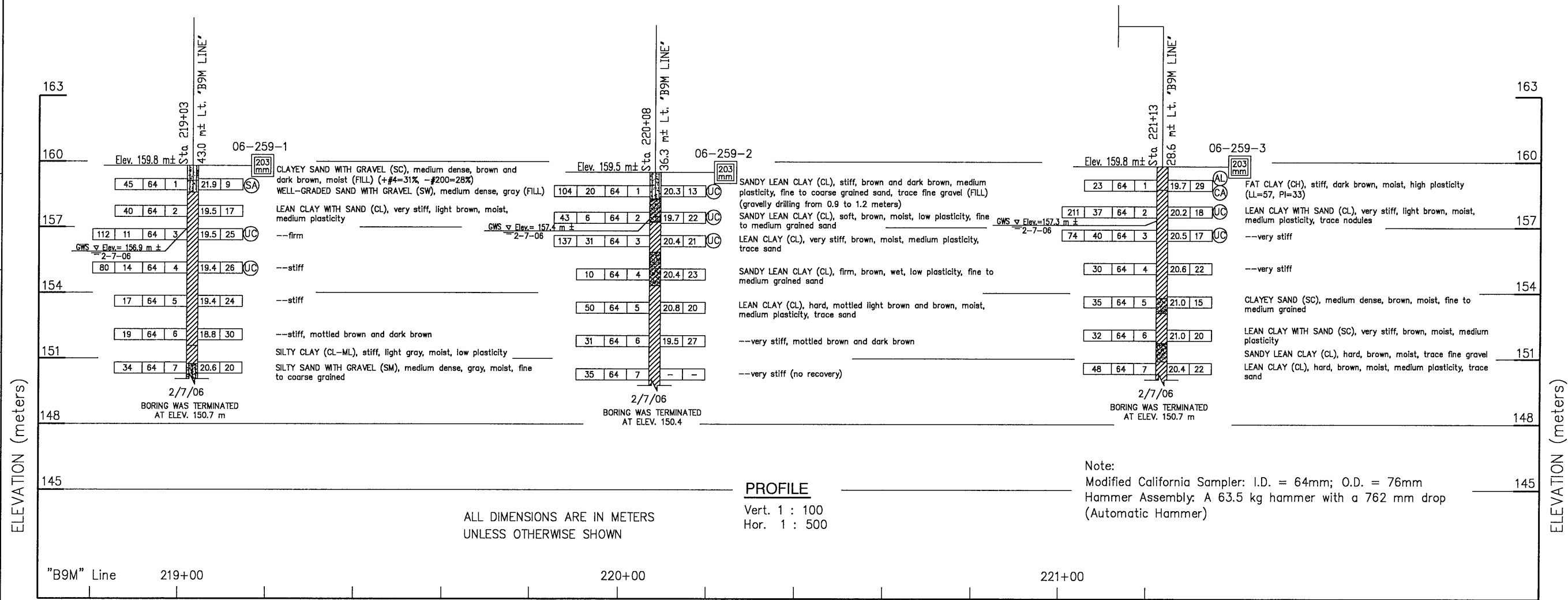
LEGEND OF EARTH MATERIALS (USCS)

CONSISTENCY CLASSIFICATION FOR SOILS

NOTE: Visual classifications of earth materials are based on field inspection and as confirmed or revised with laboratory test results as necessary.



PLAN  
1 : 500



PROFILE  
Vert. 1 : 100  
Hor. 1 : 500

Note:  
Modified California Sampler: I.D. = 64mm; O.D. = 76mm  
Hammer Assembly: A 63.5 kg hammer with a 762 mm drop  
(Automatic Hammer)

DIST 04 COUNTY Ala ROUTE 580 KILOMETER POST TOTAL PROJECT R16.5/16.9 SHEET NO. 7 TOTAL SHEETS 21

REGISTERED ENGINEER-GEOTECHNICAL  
8-10-06

PLANS APPROVAL DATE

ALAMEDA COUNTY CONGESTION MANAGEMENT AGENCY  
1333 BROADWAY, SUITE 220  
OAKLAND, CA 94612

PARIKH CONSULTANTS, INC.  
356 SOUTH MILPITAS BLVD  
MILPITAS CA 95035

PROFESSIONAL SEAL  
GARY PARIKH  
No. G.E. 666  
Exp. 12/31/07  
STATE OF CALIFORNIA

DESIGN OVERSIGHT  
SIGN OFF DATE

DESIGN By: L. TRAN  
CHECKED By: R. LAIRD

Field Investigation by: R. LAIRD

PREPARED FOR THE  
ALAMEDA COUNTY CONGESTION  
MANAGEMENT AGENCY

F. WANG  
PROJECT ENGINEER

STRUCTURE NO.  
-  
KILOMETER POST  
-

SOUND WALL SW-6  
LOG OF TEST BORINGS

DISREGARD PRINTS BEARING  
EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 1 OF 2

PLATE A-34

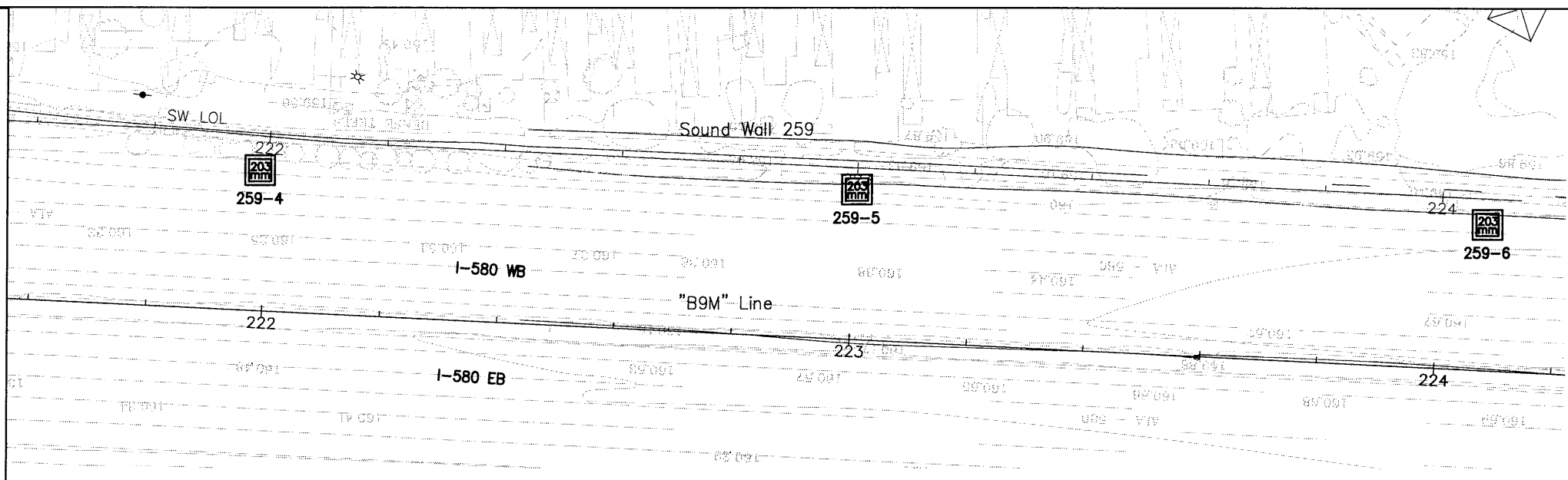
LEGEND OF BORING OPERATIONS

IN-SITU LAB & FIELD TEST DESIGNATIONS

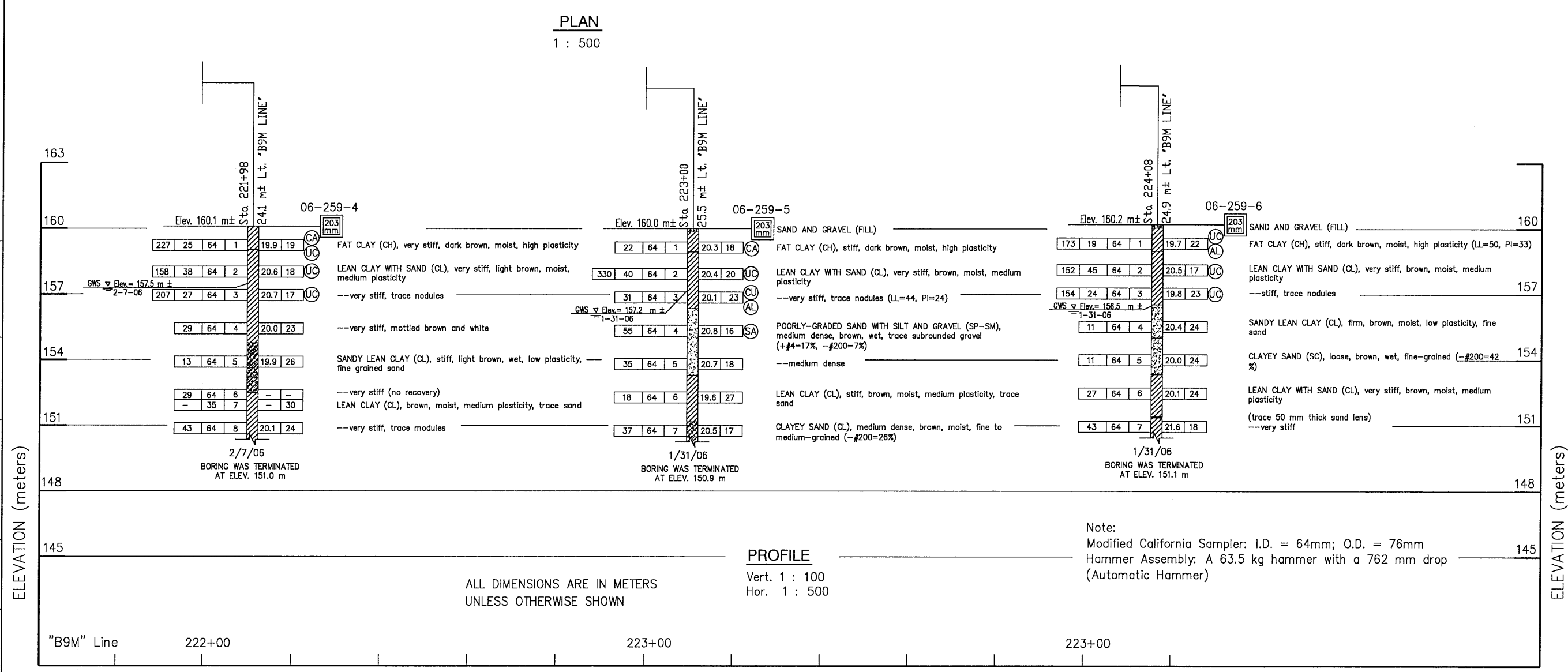
LEGEND OF EARTH MATERIALS (USCS)

CONSISTENCY CLASSIFICATION

NOTE: Visual classification of earth materials on field inspection and/or a confirmed or revised laboratory test results as necessary.



PLAN  
1 : 500



PROFILE  
Vert. 1 : 100  
Hor. 1 : 500

Note:  
Modified California Sampler: I.D. = 64mm; O.D. = 76mm  
Hammer Assembly: A 63.5 kg hammer with a 762 mm drop  
(Automatic Hammer)

ALL DIMENSIONS ARE IN METERS  
UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT	DESIGN By: L. TRAN	Field Investigation by: R. LAIRD	PREPARED FOR THE ALAMEDA COUNTY CONGESTION MANAGEMENT AGENCY	F. WANG PROJECT ENGINEER	STRUCTURE NO. -	SOUND WALL SW-7 LOG OF TEST BORINGS			
SIGN OFF DATE	CHECKED By: R. LAIRD				KILOMETER POST -				
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS						DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES (PRELIMINARY STAGE ONLY)	SHEET 2	OF 2

PLATE A-35



DIST.	COUNTY	ROUTE	KILOMETER POSTS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Ala	580	16.5/16.9	23	26

05-08-03

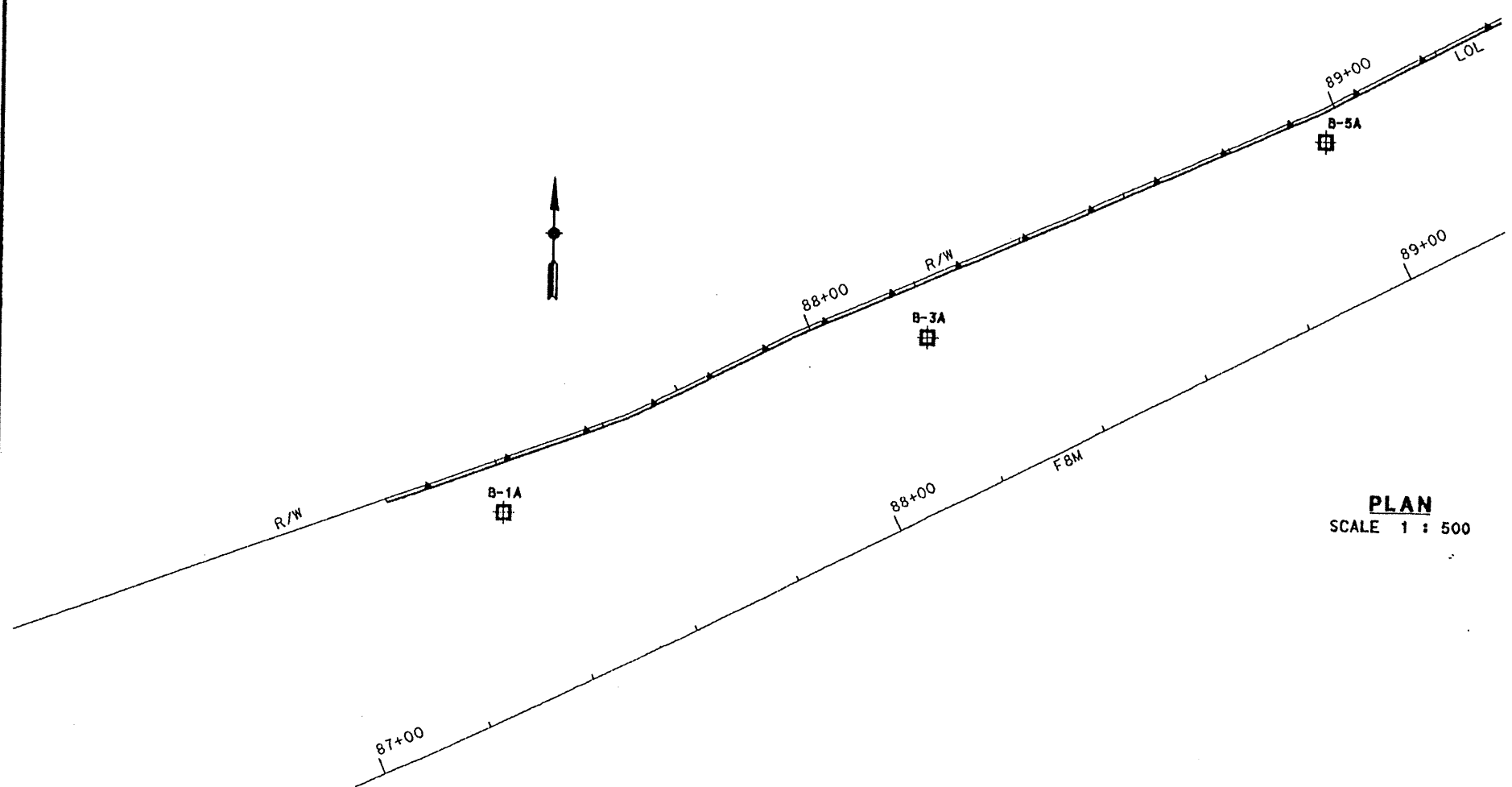
REGISTERED ENGINEER - CIVIL

PLANS APPROVAL DATE

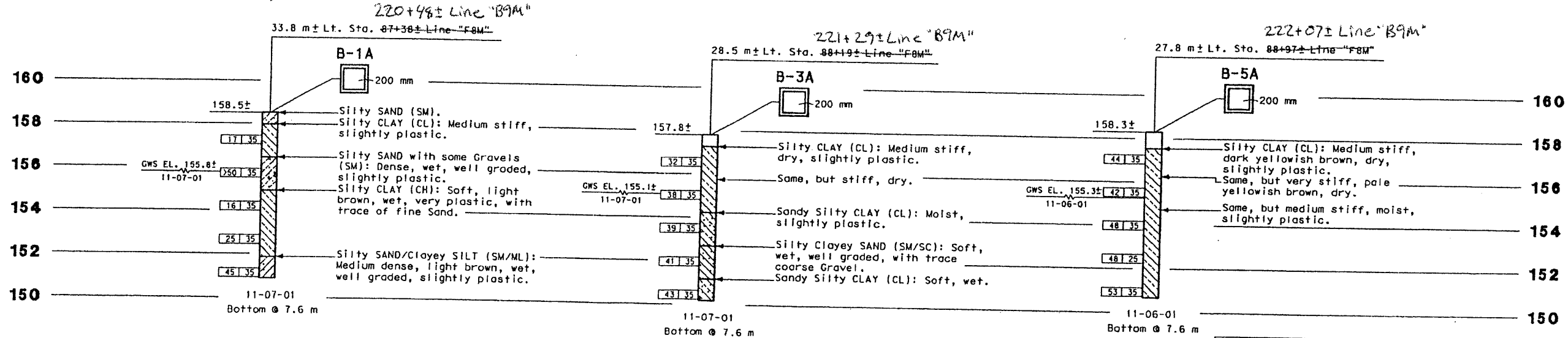
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

Caltrans now has a web site! To get to the web site, go to: <http://www.dcl.ca.gov>

All Dimensions are in Meters unless otherwise shown



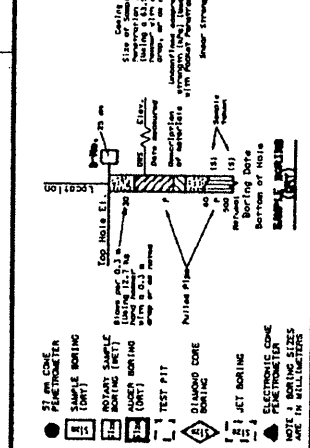
PLAN  
SCALE 1 : 500



PROFILE  
HORIZ. NO SCALE  
VERT. 1 : 100

This Log of Test Borings was created based on a "Visual Classification of Soils", (Exploration Boring Field Log), created by International Technology Corporation

LEGEND OF BORING OPERATIONS



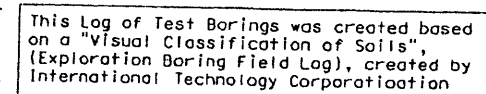
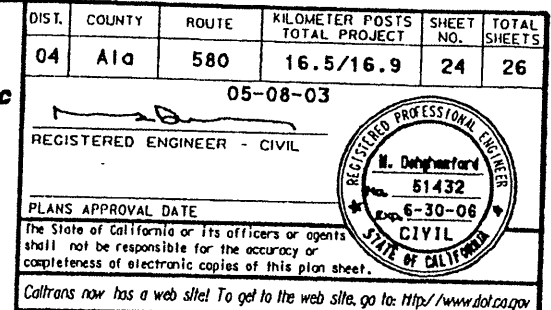
LEGEND OF EARTH MATERIALS	
	GRAVEL
	SAND
	SILTY SAND
	CLAYEY SAND
	SILTY CLAY
	CLAYEY CLAY
	SILTY CLAYEY SAND
	SILTY CLAYEY CLAY
	SILTY SAND WITH SOME GRAVELS
	SILTY CLAY WITH SOME SAND
	SILTY CLAYEY SAND WITH SOME GRAVEL
	SILTY CLAYEY CLAY WITH SOME SAND
	SILTY SAND WITH SOME GRAVEL AND SOME CLAY
	SILTY CLAY WITH SOME SAND AND SOME GRAVEL
	SILTY CLAYEY SAND WITH SOME GRAVEL AND SOME CLAY
	SILTY CLAYEY CLAY WITH SOME SAND AND SOME GRAVEL

DIVISION OF ENGINEERING SERVICES		FIELD INVESTIGATION BY M. Labedzki		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		GEOTECHNICAL SERVICES OFFICE OF GEOTECHNICAL DESIGN - WEST		BRIDGE NO. SOUNDWALL SW-5	
DRAWN BY M. Reynolds 02/02		CHECKED BY M. Delghan		CU EA 283901		REVISION DATES (PRELIMINARY STAGE ONLY)		SHEET 1 OF 2	

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS

DATE PLOTTED => 21-MAY-2003  
TIME PLOTTED => 10:06





DIVISION OF ENGINEERING SERVICES	
DRAWN BY	M. Reynolds 02/02
CHECKED BY	M. Dehghan

STATE OF  
**CALIFORNIA**  
DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL SERVICES  
OFFICE OF GEOTECHNICAL  
DESIGN - WEST

L	BRIDGE NO.
	KILOMETER POST

**SOUNDWALL** **SW-6**

# LOG OF TEST BORINGS

CU	
EA	283901

PLANITRON PLUTON BEATLES  
ELECTRON NAVIGATOR BEATLES

REVISION DATES (PRELIMINARY STAGE ONLY)						SHEET	OF
01-11-07	05-08-03					2	2

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USERNAME => obezmoli
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DATE PLOTTED => 21-MAY-2003  
TIME PLOTTED => 10:05

**TABLE 1. RECOMMENDED MINIMUM THICKNESS AND PROTECTIVE MEASURES FOR CULVERTS**

Location			Culvert Type		Corrugated Steel / Steel Spiral Rib Pipe (Galv., mm)			Reinforced Concrete	Corrugated Aluminum (mm)	Corrugated Aluminized Steel (Type 2, mm)	Steel Pipe (Gal., mm)
			Est. Service Life (yr.)		25	50	50		50	50	50
Boring Number	Station & Offset*		Resistivity (ohms-cm)	PH	Galv.(57g)		Bit. Coat. (Soil Sides)				Polymeric Coat. (90 Invert)
259-3	221+13	Lt. 28.6	1130	8.18	1.3	2.8	1.3	Note (1)	No	No	1.3
259-4	221+98	Lt. 24.1	1630	7.52	1.3	2.8	1.3	Note (1)	1.5	1.6	1.3
259-5	223+00	Lt. 25.5	380	7.81	2.0	4.3	2.0	Note (1)	No	No	1.3

**Alternative Design:** Thermoplastic pipe can be used as an alternative and should not have any corrosion concerns. However, the types of thermoplastic pipe can be used will depend on the height of fill, available sizes and manufacturer's specifications.

**Note (1):** Standard reinforced concrete pipe design is suitable with Type IP (MS) modified cement or Type II Modified cement, minimum required by Caltrans Std. Specs 90-1.01.

\* Ref. Line: "B9M" Line.

\*\*Maximum W/C ration of 0.45.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:  
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...I-580 HOV LANE

PROJECT ACCOUNT NO.205140.GDR

SAMPLE LOCATION....259-3

TEST SAMPLE NO.....1

OPERATOR.....FYW

TEST DATE.....6-29-06

\*\*\*\*\* A DATA VALUE OF ZERO INDICATES NO DATA INPUT \*\*\*\*\*

CSP SITE pH = 8.2 , WATER pH = 0.0 , SOIL pH = 8.2

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1130 , WATER = 0 , SOIL = 1130

\*\*\*\*\*

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS  
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & mm		GALV. 57 g	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	1.3	26	34	41	51	76
16	1.6	34	42	49	59	84
14	2.0	41	49	56	66	91
12	2.8	57	65	72	82	107
10	3.5	73	81	88	98	123
8	4.3	89	97	104	114	139

FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)

CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE  
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH

TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT

MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED  
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED  
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR  
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,  
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END  
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:  
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...I-580 HOV LANE

PROJECT ACCOUNT NO.205140.GDR

SAMPLE LOCATION....259-4

TEST SAMPLE NO.....1

OPERATOR.....FYW

TEST DATE.....6-26-06

\*\*\*\*\* A DATA VALUE OF ZERO INDICATES NO DATA INPUT \*\*\*\*\*

CSP SITE pH = 7.5 , WATER pH = 0.0 , SOIL pH = 7.5

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1630 , WATER = 0 , SOIL = 1630

\*\*\*\*\*

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS  
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & mm		GALV. 57 g	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	1.3	30	38	45	55	80
16	1.6	39	47	54	64	89
14	2.0	48	56	63	73	98
12	2.8	67	75	82	92	117
10	3.5	85	93	100	110	135
8	4.3	103	111	118	128	153

FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)

CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE  
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH  
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT  
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED  
IF ABRASIVE CONDITIONS DO NOT EXIST  
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED  
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR  
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,  
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END  
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:  
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...I-580 HOV LANE

PROJECT ACCOUNT NO.205140.GDR

SAMPLE LOCATION....259-5

TEST SAMPLE NO.....1

OPERATOR.....FYW

TEST DATE.....6-29-06

\*\*\*\*\* A DATA VALUE OF ZERO INDICATES NO DATA INPUT \*\*\*\*\*

CSP SITE pH = 7.8 , WATER pH = 0.0 , SOIL pH = 7.8

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 380 , WATER = 0 , SOIL = 380

CHLORIDES, PPM... 207.6 , SULFATES, PPM... 115.8

\*\*\*\*\*

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS  
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & mm		GALV. 57 g	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	1.3	16	24	31	41	66
16	1.6	21	29	36	46	71
14	2.0	26	34	41	51	76
12	2.8	36	44	51	61	86
10	3.5	47	55	62	72	97
8	4.3	57	65	72	82	107

FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)

CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE  
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP

TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT

MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED  
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED  
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR  
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,  
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END  
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.